

# NEMATODE PARASITES OF MAMMALS.

FROM SPECIMENS COLLECTED IN THE NEW YORK  
ZOOLOGICAL PARK, 1931.

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### I. INTRODUCTION.

As a part of the program outlined for parasitological research at the Animal Hospital Laboratory of the New York Zoological Park, the writer has undertaken a systematic study of the nematode parasites collected from mammals at autopsy during the year. In most cases a detailed description of the species is given, and in a few cases where identification was doubtful the abbreviation *sp.* follows the genus. Of these doubtful specimens the genus *Trichuris* affords a detailed comparative study of species collected from ten or more species of hosts. While the specimens *Strongylus sp.* from the *Equus zebra*, (Hartmann's mountain zebra) may be *equinus*, variations of the species, or a mixed infection was not determined. The specimens *Trichostrongylus sp.* from *Lemur variegatus*, (black-white lemur) were first described as new. They are now in the hands of Dr. G. Dikmans, U. S. Department of Agriculture, Washington, D. C. for verification. If these specimens prove to be new, the description with figures will be published in full in another paper. The genus *Enterobius* was found in various monkeys, but only females were obtained, and for this reason a study of the group has not been possible. A small number of *Toxocara sp.* was obtained from foxes, but no definite conclusions were made. A species of

*Physaloptera* from *Vulpes velox*, (swift or kit fox) from New Mexico appears to be new, however, to create a new species to the already much confused genus, does not seem advisable at this time.

The technique and methods of procedure are the same as those described previously by McClure (1932).

In Part III. the systematic arrangement of the hosts is that adopted by Flower (1929). The scientific and trade names, together with the dates of arrival and death are given, and the time in captivity may be ascertained. The number, name, with the location within the host, of each parasite is given.

In Part IV. the zoological order of the nematodes is adopted from Yorke and Maplestone (1926), and the species are listed alphabetically. The species previously described, McClure (1932) will only be listed, whereas species new to our collection will be briefly described. In all cases the species will be followed by a list of the hosts from which the nematodes were collected.

## II. ACKNOWLEDGMENTS.

Grateful acknowledgments are due the New York Zoological Society for the publication; Dr. Charles V. Noback, Park Veterinarian, for the material; Dr. B. G. Chitwood and Dr. G. Dikmans, U. S. Department of Agriculture, Washington, D. C. for the examination and helpful suggestions in the description of various species; and Dr. Horace W. Stunkard, New York University, for assisting in the preparation of the manuscript.

## III. SYNOPTIC LIST OF MAMMALS FROM WHICH NEMATODE PARASITES WERE COLLECTED.

### ORDER PRIMATES.

#### Family CERCOPITHECIDAE.

*Cercopithecus albogularis*, (Sykes' monkey) arrived 6/9/31; died 7/7/31.

50 *Trichostrongylus* sp. intestine.

1 *Enterobius* sp. intestine.

*Cercopithecus campbelli*, (Campbell's guenon) arrived 1/21/31; died 7/27/31.

1 *Trichuris* sp. cecum.

3 *Oesophagostomum apioistomum*, intestine.

3 *Enterobius* sp. intestine.

15 *Subulura distans*, cecum.

1 *Physaloptera* sp. stomach.

- Cercopithecus nigrigenis*, (black guenon) arrived 6/4/31; died 7/13/31.  
 4 *Trichuris* sp. intestine.  
 32 *Subulura distans*, cecum.
- Cercopithecus nictitans*, (white-nosed monkey) arrived 9/11/31; died 10/3/31.  
 6 *Trichuris* sp. cecum.
- Cercopithecus nictitans*, (white-nosed monkey) arrived 9/11/31; died 12/5/31.  
 22 *Trichuris* sp. cecum.
- Cercopithecus sabaeus*, (green monkey) arrived 10/12/29; died 3/30/31.  
 4 *Trichuris* sp. cecum.  
 327 *Subulura distans*, cecum.  
 1 *Physaloptera* sp. stomach.
- Cercopithecus sabaeus*, (green monkey) arrived 9/12/29; died 8/19/31.  
 Many *Subulura distans*, cecum.
- Cercopithecus sabaeus*, (green monkey) arrived 4/25/29; died 11/23/31.  
 35 *Subulura distans*, cecum.
- Cercopithecus sabaeus*, (green monkey) arrived 9/18/28; died 12/10/31.  
 12 *Subulura distans*, cecum.
- Macaca irus*, (Java macaque) arrived 8/6/29; died 6/24/31.  
 44 *Subulura distans*, cecum.
- Macaca irus*, (Java macaque) arrived 12/1/28; died 7/17/31.  
 16 *Subulura distans*, cecum.
- Macaca mulatta*, (Rhesus monkey) arrived 2/8/29; died 12/11/31.  
 35 *Subulura distans*, cecum.
- Macaca mulatta*, (Rhesus monkey) arrived 3/6/30; died 12/11/31.  
 11 *Subulura distans*, cecum.
- Macaca maurus*, (black macaque) arrived 10/29/30; died 7/16/31.  
 20 *Oesophagostomum apiostomum* (nodules) intestine.
- Cynopithecus niger*, ("black ape") arrived 9/23/29; died 7/10/31.  
 1 *Ternidens deminutus*, intestine.  
 26 *Subulura distans*, cecum.

#### Family CEBIDAE.

- Lagothrix humboldtii*, (woolly monkey) arrived 6/10/29; died 11/10/31.  
 7 *Enterobius* sp. intestine.  
 1 *Physaloptera* sp. (larva) stomach.
- Ateles ater*, (spider monkey) arrived 9/20/29; died 9/2/31.  
 16 *Physaloptera multiuteri*, stomach.
- Ateles ater*, (spider monkey) arrived 9/20/29; died 10/16/31.  
 14 *Physaloptera multiuteri*, stomach.
- Ateles ater*, (spider monkey) arrived 9/20/29; died 10/20/31.  
 5 *Physaloptera multiuteri*, stomach.
- Ateles ater*, (spider monkey) arrived 11/8/29; died 10/28/31.  
 2 *Physaloptera multiuteri*, stomach.
- Ateles ater*, (spider monkey) arrived 9/20/29; died 12/3/31.  
 4 *Physaloptera multiuteri*, stomach.

## Family LEMURIDAE.

*Lemur variegatus*, (black-white lemur) arrived 4/5/30; died 9/11/31.

36 *Trichostrongylus* sp. intestine.

## ORDER CARNIVORA.

## Family FELIDAE.

*Felis leo*, (lion) arrived 9/24/29; died 8/10/31.

115 *Toxascaris leonina*, intestine.

*Felis tigris*, (Bengal tiger) arrived 6/19/30; died 1/24/31.

6 *Toxascaris leonina*, intestine.

*Felis onca*, (jaguar) arrived 6/8/31; died 7/24/31.

2 *Ancylostoma pluridentatum*, intestine.

1 *Toxocara mystax*, intestine.

*Felis concolor*, (puma) arrived 7/3/31; died 7/14/31.

25 *Ancylostoma pluridentatum*, intestine.

1 *Toxocara mystax*, intestine.

*Felis pardalis*, (ocelot) arrived 12/22/30; died 1/17/31.

8 *Ancylostoma braziliense*, intestine.

1 *Ancylostoma caninum*, intestine.

*Felis yaguarondi*, (Jaguarondi cat) arrived 4/6/31; died 5/3/31.

9 *Ancylostoma pluridentatum*, intestine.

## Family CANIDAE.

*Vulpes velox*, (swift or kit fox) arrived 8/25/31; died 8/25/31.

1 *Toxocara* sp. intestine.

15 *Physaloptera* sp. stomach.

*Vulpes zerda*, (fennec fox) arrived 6/20/31; died 6/30/31.

1 *Ancylostoma caninum*, intestine.

1 *Ancylostoma braziliense*, intestine.

6 *Uncinaria stenocephala*, intestine.

3 *Physaloptera* sp. stomach.

*Vulpes zerda*, (fennec fox) arrived 6/20/31; died 7/4/31.

5 *Toxascaris* sp. intestine.

## Family PROCYONIDAE.

*Potos flavus*, (kinkajou) arrived 2/18/31; died 11/2/31.

1 *Physaloptera* sp. stomach.

*Procyon lotor*, (raccoon) arrived 9/3/23; died 12/1/31.

10 *Ascaris columnaris*, intestine.

## ORDER RODENTIA.

## Family CASTORIDAE.

*Castor canadensis*, (Canadian beaver) arrived 7/11/29; died 7/1/31.

34 *Travassosius americanus*, intestine.



## Family MURIDAE.

*Cricetomys gambianus*, (pouched rat) arrived 10/7/30; died 12/3/31.

7 *Heterakis dahomensis*, intestine.

## Family ERETHIZONTIDAE.

*Erethizon dorsatum*, (Canadian porcupine) arrived 4/25/31; died 5/12/31.

Many *Wellcomia evoluta*, intestine.

*Coendou prehensilis*, (prehensile-tailed porcupine) arrived 4/30/31; died 5/7/31.

6 *Ancylostoma pluridentatum*, intestine.

## ORDER PERISSODACTYLA.

## Family EQUIDAE.

*Equus grevyi*, (Grevy's zebra) arrived 8/15/30; died 8/10/31.

Many *Parascaris equorum*, intestine.

*Equus zebra*, (Hartmann's mountain zebra) arrived 11/4/30; died 4/26/31.

25 *Strongylus* sp. intestine.

4 *Strongylus* sp. (nodules) intestine.

Many *Dictyocaulus arnfieldi*, lungs.

1 *Parascaris equorum*, intestine.

*Equus burchellii chapmani*, (Chapman's zebra) arrived 5/30/27; died 8/20/31.

Many *Parascaris equorum*, intestine.

## ORDER ARTIODACTYLA.

## Family BOVIDAE.

*Bison bison*, (American bison) arrived 12/10/21; died 9/13/31.

3 *Setaria labiato-papillosa*, body cavity.

*Bison bison*, (American bison) arrived 9/23/26; died 10/29/31.

1 *Setaria labiato-papillosa*, body cavity.

*Oryx beisa*, (fringe-eared beisa) arrived 7/16/14; died 1/7/31.

26 *Trichuris* sp. cecum.

1 *Oxyuroidea* sp. intestine.

## IV. SYNOPSIS LIST OF NEMATODE PARASITES.

Superfamily TRICHUROIDEA Railliet 1916.

Family TRICHURIDAE Railliet 1915.

Subfamily TRICHURINAE Ransom 1911.

*Trichuris* sp. .... 35

Superfamily STRONGYLOIDEA Weinland 1853; Hall 1916.

Family STRONGYLIDAE Baird 1853.

Subfamily STRONGYLINAE Railliet 1893.

*Strongylus* sp. .... 35

## Subfamily OESOPHAGOSTOMINAE Railliet 1915.

<i>Oesophagostomum apiostomum</i> (Willach 1891).....	35
<i>Ternidens deminutus</i> (Railliet and Henry 1905).....	36

## Family ANCYLOSTOMIDAE (Looss 1905) Lane 1917.

## Subfamily ANCYLOSTOMINAE (Looss 1905) Stephens 1916.

<i>Ancylostoma braziliense</i> de Faria 1910.....	36
<i>Ancylostoma caninum</i> (Ercolani 1859).....	37
<i>Ancylostoma pluriidentatum</i> (Alessandrini 1905).....	37

## Subfamily NECATORINAE Lane 1917.

<i>Uncinaria stenocephala</i> (Railliet 1884).....	38
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## Family TRICHOSTRONGYLIDAE Leiper 1912.

## Subfamily TRICHOSTRONGYLINAE Leiper 1908.

<i>Trichostrongylus</i> sp.....	38
<i>Travassosius americanus</i> Chapin 1925.....	38

## Family METASTRONGYLIDAE Leiper 1908.

## Subfamily METASTRONGYLINAE Leiper 1908.

<i>Dictyocaulus arnfieldi</i> (Cobbold 1884).....	39
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## Superfamily OXYUROIDEA Railliet 1916.

## Family OXYURIDAE Cobbold 1864.

## Subfamily OXYURINAE Hall 1916.

<i>Enterobius</i> sp.....	40
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## Subfamily SYPHACIINAE Railliet 1916.

<i>Wellcomeia evoluta</i> (Linstow 1899).....	40
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## Family HETERAKIDAE Railliet and Henry 1914.

## Subfamily HETERAKINAE Railliet and Henry 1912.

<i>Heterakis dahomensis</i> Gendre 1911.....	40
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## Family SUBULURIDAE Yorke and Maplestone 1926.

## Subfamily SUBULURINAE Travassos 1914.

<i>Subulura distans</i> (Rudolphi 1809).....	42
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## Superfamily ASCAROIDEA Railliet and Henry 1915.

## Family ASCARIDAE Baird 1853.

## Subfamily ASCARINAE (Railliet and Henry 1912) Travassos 1913.

<i>Ascaris columnaris</i> (Leidy 1856).....	42
<i>Toxocara mystax</i> (Zeder 1800).....	43
<i>Toxocara</i> sp.....	43

<i>Toxascaris</i> sp. ....	43
<i>Toxascaris leonina</i> (Linstow 1902) .....	43
<i>Parascaris equorum</i> (Goeze 1782) .....	43

Superfamily SPIRUOIDEA Railliet and Henry 1915.

Family PHYSALOPTERIDAE Leiper 1908.

Subfamily PHYSALOPTERINAE Railliet 1893.

<i>Physaloptera multiuteri</i> Canavan 1929 .....	44
<i>Physaloptera</i> sp. ....	45

Superfamily FILARIOIDEA Weinland 1858; Stiles 1907.

Family FILARIIDAE (Cobbold 1864) Claus 1885.

Subfamily SETARIINAE Yorke and Maplestone 1926.

<i>Setaria labiato-papillosa</i> (Aless. 1838) .....	45
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*Trichuris* sp.

The specimens representing the genus *Trichuris* are retained for further consideration.

No. <sup>1</sup>	Hosts.
311,	<i>Cercopithecus campbelli</i> , (Campbell's guenon).
312,	<i>Cercopithecus nigrigenis</i> , (black guenon).
313, 314,	<i>Cercopithecus nictitans</i> , (white-nosed monkey).
315,	<i>Cercopithecus sabaeus</i> , (green monkey).
316,	<i>Oryx beisa</i> , (fringe-eared beisa).

*Strongylus* sp.

Specimens of the genus *Strongylus* from a zebra were found to belong to two or more species. Some specimens contained two dorsal and two sub-ventral teeth at the base of the buccal capsule, while others had only two rounded teeth. In some cases the elements of the external leaf-crown appeared doubled or bifid, while in others it appeared fringed. Until the writer can obtain access to Looss' famous monograph on the "Sclerostomes of the Equidae," it is thought advisable to retain these specimens for further study.

No.	Host.
317,	<i>Equus zebra</i> , (Hartmann's mountain zebra).

*Oesophagostomum apiostomum* (Willach 1891).

A detailed description of this species may be found on page 10, McClure (1932).

No.	Hosts.
318,	<i>Cercopithecus campbelli</i> , (Campbell's guenon).
319,	<i>Macaca maurus</i> , (black macaque).

<sup>1</sup>The numbers preceding the hosts are those of the preserved specimens, deposited in the Animal Hospital Laboratory of the New York Zoological Park

*Ternidens deminutus* (Railliet and Henry 1905).

Only one specimen, a male, of this species was found, and a detailed description will be deferred until more material is available, however, the following gross description will be given.

Its length is 8.5 mm., and its width 530  $\mu$ . A transverse cervical groove is present. The buccal capsule is subglobular in shape. The oesophageal funnel is dilated and contains three teeth, each consisting of two lamellae, projecting into the buccal capsule. The oesophagus is club-like, and measures 829  $\mu$ . long and 247  $\mu$  wide near the posterior end. The bursa formula is as in oesophagostomum. The spicules are equal and measure 1.2 mm. in length.

No.	Host.
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3110,	<i>Cynopithecus niger</i> , ("black ape").
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*Ancylostoma braziliense* de Faria 1910.

The males vary in length from 6.5 mm. to 7.7 mm. and in breadth from 246  $\mu$  to 300  $\mu$  maximum thickness. The cuticle is transversely striated at intervals of about 5  $\mu$  at the posterior end of the oesophagus. The cervical papillae are located about 454  $\mu$  from the anterior end of the body. The head is bent dorsally and contains one pair of large ventral teeth and one rudimentary inner pair. There is no dorsal teeth present. The buccal capsule is about 103  $\mu$  wide. The oesophagus varies from 635  $\mu$  to 688  $\mu$  long, and from 124  $\mu$  to 148  $\mu$  wide near the posterior end. The nerve ring encircles the oesophagus about 320  $\mu$  from the anterior end.

The bursa is well developed and supported by the ventral and dorsal systems of rays. The lateral system is composed of two ventral and three lateral rays. The ventro-ventral and latro-ventral rays appear united half their entire length, are equal, measuring about 115.6  $\mu$  long. The latro-ventral ray is slightly broader than the ventro-ventral. Their tips extend within a short distance from the margin of the bursa. The lateral system is cleft equally. The externo-lateral ray is about 123  $\mu$  long, divergent, and terminates quite a distance from the margin of the bursa. The medio-lateral and postero-lateral rays lie close together and parallel. The postero-lateral is slightly longer and terminates near the margin of the bursa. The dorsal system is composed of the dorsal and externo-dorsal rays. The externo-dorsal rays are about 157  $\mu$  long and are given off from the dorsal ray about 62  $\mu$  from the base. They terminate within 20  $\mu$  of the border of the lateral lobes. The dorsal lobe continues about 103  $\mu$  and bifurcates. About 12  $\mu$  further a lateral branch appears bifurcated distally. Their ends terminate near the border of the small dorsal lobe. The spicules are apparently equal in length, and measure about 817  $\mu$  long, and about 8  $\mu$  wide at the base. The gubernaculum measures about 66  $\mu$  long, and 10  $\mu$  wide. The prebursal papillae are located about 309  $\mu$  from the posterior margin of the lateral lobe.

The females vary in length from 7.7 mm. to 8.8 mm., and in width from 265  $\mu$  to 335  $\mu$ . The cuticle is transversely striated at intervals of about 8  $\mu$  at the posterior end of the oesophagus. The cervical papillae are located about 644  $\mu$  from the anterior end of the body. The arrangement of the teeth and

general cephalic structures are similar to those of the male. The buccal capsule is approximately  $95\ \mu$  wide. The oesophagus varies in length from  $794\ \mu$  to  $829\ \mu$  in length and from  $132\ \mu$  to  $165\ \mu$  in width near the posterior end. The nerve ring is about  $310\ \mu$  from the anterior end of the oesophagus, and just anterior to the cervical papillae.

The vulva is located in the last third of the body. The tail is from  $157\ \mu$  to  $187\ \mu$  long and from  $91\ \mu$  to  $103\ \mu$  wide. It is gradually attenuated and ends in a slender bristle about  $25\ \mu$  long.

No.	Hosts.
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3111,	<i>Felis pardalis</i> , (ocelot).
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3112,	<i>Vulpes zerda</i> , (fennec fox).
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*Ancylostoma caninum* (Ercolani 1859).

Only two specimens, females, of this species were found. Until more specimens may be obtained no detailed description will be given, however, on page 12 McClure, (1932), a brief description of the female, based upon one specimen may be found.

No.	Hosts.
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3113,	<i>Felis pardalis</i> , (ocelot).
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3114,	<i>Vulpes zerda</i> , (fennec fox).
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*Ancylostoma pluridentatum* (Alessandrini 1905).

The males vary in length from 7 mm. to 8 mm. and in breadth from  $300\ \mu$  to  $350\ \mu$  just in front of the bursa. The cuticle is transversely striated at intervals of about  $5.6\ \mu$  at the posterior end of the oesophagus. The cervical papillae are located about  $617\ \mu$  from the anterior end of the body. The head is bent dorsally and contains two pairs of teeth, one pair very much reduced, in the anterior and ventral portions of the mouth capsule, and three small teeth on each side of the dorsal wall of the mouth. The buccal capsule is from  $124\ \mu$  to  $145\ \mu$  wide. The oesophagus is about  $750\ \mu$  long and  $160\ \mu$  maximum width. The nerve ring is about  $265\ \mu$  from the anterior end of the body.

The bursa is well developed and supported by the ventral and dorsal rays. The lateral system is composed of two ventral and three lateral rays. The ventro-ventral and latro-ventral rays are given off somewhat dorsally and appear united for more than half their entire length. The former measures about  $160\ \mu$  in length while the latter is about  $153\ \mu$  long. The latro-ventral ray is slightly wider than the ventro-ventral ray, and their tips extend within a short distance from the margin of the bursa. The externo-lateral ray is rather small, measures about  $908\ \mu$  long and terminates quite a distance from the margin of the bursa. The medio-lateral and postero-lateral rays are large and parallel. They terminate near the posterior margin of the lateral lobes of the bursa. The dorsal system is composed of the dorsal and externo-dorsal rays. The externo-dorsal rays are about  $268\ \mu$  long, and are given off near the base of the dorsal ray, which terminates quite a distance from the border of the lateral lobes. About  $138\ \mu$  from the junction of the externo-dorsal ray the dorsal ray bifurcates and each branch tridigitates. Their ends terminate at the border of



the small dorsal lobe. The spicules are long and slender. They measure from 1.2 mm. to 1.3 mm. long, and about  $5\ \mu$  wide just posterior to the enlarged base. The gubernaculum is short, about  $70\ \mu$  long and  $16\ \mu$  wide at the broadest point. The prebursal papillae are located about  $570\ \mu$  from the posterior margin of the lateral lobes. There appears to be a granular structure on each side of the anal opening.

The females vary in length from 8.3 mm. to 11 mm. and in breadth from  $352\ \mu$  to  $360\ \mu$ . The cuticle is transversely striated at intervals of about  $6.8\ \mu$  at the posterior end of the oesophagus. The cervical papillae are located about  $582\ \mu$  from the anterior end of the body. The arrangement of the teeth and general cephalic structures are similar to those of the male. The diameter of the buccal capsule is approximately  $165\ \mu$ . The oesophagus varies in length from  $776\ \mu$  to  $811\ \mu$  and in width from  $194\ \mu$  to  $211\ \mu$ . The nerve ring is anterior to the cervical papillae.

The vulva is located in the posterior third. In a specimen 8.3 mm. long the vulva was 2.7 mm. from the posterior end. The tail is from  $128\ \mu$  to  $148\ \mu$  long and from  $82\ \mu$  to  $94\ \mu$  wide at the base. It is gradually attenuated and ends in a slender bristle from  $15\ \mu$  to  $28\ \mu$  long.

No. Hosts.

3115, *Felis concolor*, (puma).

3116, *Felis onca*, (jaguar).

3117, *Felis yaguarondi*, (jaguarondi cat).

3118, *Coendou prehensilis*, (prehensile-tailed porcupine).

*Uncinaria stenocephala* (Railliet 1884).

A detailed description of this species may be found on page 13, McClure (1932).

No. Host.

3119, *Vulpes zerda*, (fennec fox).

*Trichostrongylus* sp.

This genus is represented by at least one species. The specimens are retained for further study.

No. Hosts.

3120, *Lemur variegatus*, (black-white lemur).

3121, *Cercopithecus albogularis* (Sykes' monkey).

*Travassosius americanus* Chapin, 1925.

The description given here varies in some respects to that given by Chapin, 1925, however, the writer feels certain the specimens belong to the species *Travassosius americanus*.

The males vary in length from 8.8 mm. to 12.9 mm. and in breadth from  $176\ \mu$  to  $201\ \mu$ . The body is straight, filiform and attenuated anteriorly. The cuticle is transversely striated anteriorly and contains at least 28 longitudinal striae around the circumference of the body. The excretory pore is located

about 290  $\mu$  from the anterior end. The cervical papillae are large, conical and directed caudad. They vary greatly in position from 421  $\mu$  to 553  $\mu$ , from the anterior end of the body. The head is without well-developed lips or head papillae. Its diameter is about 29  $\mu$ . There is no buccal capsule. The oesophagus varies in length from 547  $\mu$  to 617  $\mu$ . Its width at the anterior end is about 33  $\mu$  and the posterior end is about 66  $\mu$  wide. The nerve ring encircles it about 256  $\mu$  from the anterior end.

The bursa is closed all around, with no distinct dorsal lobes. The ventro-ventral ray is very small, horizontal, and widely separated from the latro-ventral ray. The laterals and ventro-ventral rays rise from a common trunk. The tip of the latro-ventral is directed anteriorly. The lateral rays are approximately equal in thickness, the medio-lateral is straight, while the tip of the dorso-lateral is directed dorsally. The externo-dorsal ray rises from the base of the dorsal ray. It is thick and ends near the margin of the bursa. The dorsal ray is thin and bifurcates about 80  $\mu$  from the base. Each branch is about 27  $\mu$  long, and bifurcates at the margin of the bursa. The prebursal papillae are located about 63  $\mu$  anterior to the bursa. There are two hollow spicules, equal in length, varying from 157  $\mu$  to 186  $\mu$ . The cephalic end is cup-like; a groove runs along the ventral side; near the caudal end are two spur-like projections; and the caudal end is rounded or knob-like. The genital cone is prominent, and a large papillae is on each side of the cloaca. There is no gubernaculum present.

The females vary in length from 11 mm. to 15 mm. and in breadth from 180  $\mu$  to 211  $\mu$ . The body is straight, filiform, and attenuated both anteriorly and posteriorly. The excretory pore varies in position from 269  $\mu$  to 300  $\mu$ , while the cervical papillae varies from 392  $\mu$  to 466  $\mu$  from the anterior extremity. The cuticle and general cephalic structures are similar to those described for the male. The head diameter is about 29  $\mu$ . The oesophagus is about 617  $\mu$  long, 24  $\mu$  wide at the anterior end and about 72  $\mu$  wide near the posterior end. The nerve ring is located about 290  $\mu$  from the anterior end.

The vulva is located about 3.5 mm. from the posterior end of the body. The vagina is short. The combined length of the ovijector including the two sphincters is about 953  $\mu$ . The uteri run in either direction. The tail ends abruptly without a spine, it measures about 326  $\mu$  long and 62  $\mu$  wide at the anus. The ova measure 48.7  $\mu$  by 83  $\mu$  an average of 10.

No. Host.

3122, *Castor canadensis*, (Canadian beaver).

*Dictyocaulus arnfieldi* (Cobbold, 1884).

The males vary in length from 32 mm. to 38 mm. and in breadth from 353  $\mu$  to 388  $\mu$ . The body is long and filiform. The cuticle is marked by both transverse and longitudinal striae. The excretory pore is located about 456  $\mu$  from the anterior end of the body. There are no cervical papillae present. The head diameter is about 74  $\mu$ . No head papillae were observed. The mouth cavity is simple and opens directly into the oesophagus, which is about 741  $\mu$  long, 74  $\mu$  wide at the anterior end, and 128  $\mu$  wide near the posterior end. The nerve ring is located about 293  $\mu$  from the anterior end.

The lobes of the bursa are not distinct. The rays are bluntly pointed and never reach the margin of the bursa. The ventro-ventral and latro-ventral rays are united for half their length, and are directed anteriorly. The lateral rays rise from a common trunk, the externo-lateral is given off first. The medio-lateral and dorso-lateral rays are fused for a greater part of their length. The externo-dorsal rays rise near the base of the dorsal ray, and are long, slender, and has an enlarged extremity. The dorsal ray is stout and bifurcates about half way down its main stem, and each branch terminates in an enlargement but never branches. The spicules are large, somewhat club-shaped and closely applied to each other. They are about  $239\ \mu$  long, and have a honey-comb structure. The gubernaculum, if present, is very rudimentary. There are no prebursal papillae present.

The females vary in length from 50 mm. to 70 mm. and in breadth from  $423\ \mu$  to  $441\ \mu$ . The excretory pore is located about  $457\ \mu$  from the anterior end of the body. The shape, cuticle, and general cephalic characters are similar to those described for the male. The head diameter is about  $82\ \mu$ . The oesophagus is about  $806\ \mu$  long,  $83\ \mu$  wide at the anterior end, and  $143\ \mu$  wide near the posterior end. The nerve ring is located about  $300\ \mu$  from the anterior end of the oesophagus.

The vulva is located just anterior to the middle of the body. The vagina is short and leads directly into the ovijectors, which measure including the two sphincters about 2.24 mm. long. The tail is pointed, about  $344\ \mu$  long and  $92\ \mu$  wide at the base. Two small caudal papillae are located about  $157\ \mu$  from the posterior end, but never project through the cuticle. The eggs are ovoid, measuring  $47\ \mu$  by  $99.5\ \mu$ , an average of 10. They contain a living embryo when deposited.

No. Host.

3123, *Equus zebra* (Hartmann's mountain zebra).

*Enterobius* sp.

In this genus only females were found and the determination of the species was deferred until more specimens can be obtained.

No. Hosts.

3124, *Cercopithecus campbelli*, (Campbell's guenon).

3125, *Cercopithecus albogularis*, (Sykes' monkey).

3126, *Lagothrix humboldtii*, (woolly monkey).

*Wellcomia evoluta* (Linstow 1899).

A brief description of this species may be found on page 16, McClure (1932), however, head papillae have been observed and other slight modification of the description may follow later.

No. Host.

3127, *Erethizon dorsatum*, (Canadian porcupine).

*Heterakis dahomensis* Gendre 1911.

This species is regarded by Hall, (1915) as a synonym of *H. spumosa* Schneider (1866), and may be properly regarded as such. Gendre (1911)

and Boulenger (1923), however, regard the specimens from *Cricetomys gambianus* as a distinct species. Yorke and Maplestone (1926) list it as such. In many respects it resembles *H. spumosa* so closely that the writer is in some doubt whether or not the specimens are properly placed. Nevertheless, until further comparisons can be made, these specimens will be labeled *Heterakis dahomensis* Gendre 1911.

Only two males were present, they measured 9.7 mm. and 11.5 mm. in length, and 476  $\mu$  and 494  $\mu$  in breadth. Their bodies were slightly attenuated anteriorly and the cuticle showed both longitudinal and transverse striations, the latter about 4  $\mu$  apart. The lateral cuticular membrane originates on each side about 63  $\mu$  from the anterior end of the body, and attains its maximum breadth near the posterior end of the oesophagus, then narrows slightly and extends into the caudal region. The excretory pore is located from 475  $\mu$  to 512  $\mu$ , while the cervical papillae are located from 582  $\mu$  to 600  $\mu$  from the anterior end of the body. The head diameter is approximately 85  $\mu$ . There are three distinct lips, each bearing two lateral papillae. No median papilla was observed. The mouth cavity is followed immediately by the oesophagus which varies in length from .985 mm. to 1.05 mm. including the oesophageal bulb. The oesophageal bulb is about 176  $\mu$  wide and cannot be easily distinguished from the oesophagus. The nerve ring encircles the oesophagus about 340  $\mu$  from the anterior end.

There is a well developed bursa originating from 900  $\mu$  to 970  $\mu$  from the tip of the tail. There appears to be three pairs of distinct lateral lobes and one well defined dorsal lobe. About 600  $\mu$  to 617  $\mu$  from the caudal end, located on a well developed muscular stand, is a powerful pedunculated sucker. It has a strong chitinous investment interrupted on the posterior border by a papilliform elevation. The sucker is elliptical, having a transverse diameter from 83  $\mu$  to 103  $\mu$ , and a longitudinal diameter from 103  $\mu$  to 116  $\mu$ . In this vicinity are two pairs of stalked ventral papillae. In the largest specimen the most anterior pair originates about 12  $\mu$  anterior to the sucker, and is about 153  $\mu$  apart. The posterior pair originates opposite the sucker and are about 124  $\mu$  apart. These structures support the first lobes of the bursa. The second lobe is supported by three pairs of laterally situated papillae, the first pair being preanal and the largest. The second pair is adanal and the shortest. The third pair is postanal and is longer than the second pair. It marks the end of the second lobe. The anal opening is located from 355  $\mu$  to 363  $\mu$  from the end of the tail. There are two pairs of ventral sessile papillae located on each side of the anal opening. The third lobe is not supported by papillae. The dorsal lobe is supported by the tail, which is long and pointed, and three pairs of papillae. The first pair is the thinnest and very difficult to see; the second pair the thickest; and the third pair intermediate in thickness. The spicules are subequal and vary in length from 353  $\mu$  to 375  $\mu$ .

The females vary in length from 10.5 mm. to 12 mm. and from 485  $\mu$  to 529  $\mu$  maximum thickness. The body is slightly attenuated in both directions, reaching its maximum thickness about the middle. The striations, lateral cuticle membranes, and general cephalic structures are similar to those of the male. The excretory pore is located from 441  $\mu$  to 547  $\mu$ , while the cervical



papillae are located from 494  $\mu$  to 617  $\mu$  from the anterior end of the body, but always behind the excretory pore. The oesophagus varies in length from .88 mm. to 1 mm. including the oesophageal bulb. The bulb varies in width from 176  $\mu$  to 211  $\mu$ . The nerve ring encircles it about 352  $\mu$  from the anterior end.

The vulva is a transverse slit with prominent lips situated about the middle of the body, usually in the anterior half. On each side of the lips there is one or more cuticular prominence. The tail is pointed and measures from .97 mm. to 1 mm. long and 194  $\mu$  to 211  $\mu$  wide at the base. The ova are mamillated and measure 49.9  $\mu$  by 75.5  $\mu$ , an average of ten.

No. Host.

3128, *Cricetomys gambianus*, (pouched rat).

*Subulura distans* (Rudolphi 1809).

A brief description of this species may be found on page 19 McClure (1932).

No. Hosts.

3129, *Cercopithecus campbelli*, (Campbell's guenon).

3130, *Cercopithecus nigrigenis*, (black guenon).

3131, 3132, 3133, 3134, *Cercopithecus sabaeus*, (green monkey).

3135, 3136, *Macaca irus*, (Java macaque).

3137, 3138, *Macaca mulatta*, (Rhesus monkey).

3139, *Cynopithecus niger*, ("black ape").

*Ascaris columnaris* (Leidy 1856).

There was only one male present and it had been cut at autopsy, however, the posterior end measured 43 mm. in length and 1.5 mm. in width. The body was slender and terminated in a conical tail without caudal alae.

There are at least 46 caudal papillae and one unpaired caudal papilla present. The 41 pairs of preanal papillae are irregularly distributed in two subventral slightly divergent rows, the most anterior ones difficult to see. The one unpaired papilla is rather large and located just anterior to the anal opening. There are no adanal papillae. The five pairs of postanal papillae are distributed as follows: one pair of double papillae just posterior to the anus; four pairs in a group near the tip of the tail, the first, (or second pair of preanal papillae) is large and doubled, while the others are smaller and single, the most caudal pair being about 82  $\mu$  from the end of the tail. The spicules are equal, non-alate, tubular and relatively short and stout. They measure about 476  $\mu$  in length and 53  $\mu$  in width at their base. The anal opening is crescent-like and measures 145  $\mu$  wide. There are two slightly raised roughened pads present, anterior and posterior to the anus. The tail terminates in a small "spike" and is about 406  $\mu$  long and 529  $\mu$  wide at the base. This "spike" projects through the cuticle, which is slightly swollen in this region.

The females vary in length from 60 mm. to 90 mm. and in breadth from 1 mm. to 1.5 mm. The body is long and slender and tapers toward both ends. The cuticle is loosely connected and lies in irregular folds on the body. It is striated transversely at intervals of about 6  $\mu$ . The excretory pore is located about 1 mm. from the anterior end of the body. There are three well devel-



oped hexagonal lips, with no interlabia present. The head diameter is about  $476\ \mu$ . The lip pulp contains two distinct anterior lobes each slightly bifurcated distally. On the dorsal lip the pulp has two additional lateral elongations, while the sub-ventrals have one each, which forms the base of the papillae. The lips bear four papillae, two on the dorsal, and one each on the sub-ventral lips. Each papilla appears doubled in form, one large and dome-like, while the other small and projects from the side of the large papilla. The muscular oesophagus varies in length from 3 mm. to 3.3 mm. and in width from  $476\ \mu$  to  $617\ \mu$  at the posterior end. The nerve ring is located about  $476\ \mu$  from the anterior end.

The vulva is a transverse slit, located 25 mm. to 30 mm. from the anterior end. The vagina is about 2.5 mm. long and  $247\ \mu$  wide near the vulva. The two uteri are fused for a distance of about 1.2 mm. The tail is conical about  $700\ \mu$  long and  $441\ \mu$  wide, and terminates in a spike similar to that in the male. There are no preanal papillae present. The ova are finely mamillated and measure  $13.6\ \mu$  by  $17.7\ \mu$ , an average of ten enteruteri.

No. Host.

3140, *Procyon lotor*, (raccoon).

*Toxocara mystax* (Zeder 1800).

A brief description of this species may be found on page 20 McClure (1932).

No. Hosts.

3141, *Felis onca*, (jaguar).

3142, *Felis concolor*, (puma).

*Toxocara* sp.

No. Hosts.

3143, *Vulpes velox*, (swift or kit fox).

*Toxascaris* sp.

No. Host.

3144, *Vulpes zerda*, (fennec fox).

*Toxascaris leonina* (Linstow 1902).

For the description of this species see page 21 McClure (1932).

No. Hosts.

3145, *Felis leo*, (lion).

3146, *Felis tigris*, (Bengal tiger).

*Parascaris equorum* (Goeze 1782) Yorke and Maplestone 1926.

The males vary in length from 150 mm. to 190 mm. and in breadth from 3 mm. to 4.5 mm. The body is long and stout. It tapers in both directions. The cuticle is striated transversely at intervals of about  $10\ \mu$  near the anterior end. There are three large quadrangular lips, with rudimentary interlabia. Each lip has a well-marked anterior lobe separated from the base by a deep

transverse groove on the inner surface. The peripheral margin of the lips is transparent and bordered by dentigerous ridges. A deep longitudinal fissure divides the pulp into two anterior lobes. The dorsal lip bears two large double papillae and each subventral lip one large double papilla. The oesophagus measures in length up to 12 mm. and about 1 mm. wide at the anterior end, and 1.5 mm. at the posterior end. The nerve ring is located about 2.5 mm. from the anterior end of the oesophagus.

The posterior extremity is bluntly conical and somewhat ventrally curved. There are small caudal alae present. There are numerous preanal papillae arranged in three longitudinal subventral rows on each side; one large unpaired preanal papilla located just anterior to the anus; and 7 pairs, three double and one single postanal papillae present. There are no adanal papillae. The spicules are sub-equal being about 3.3 mm. and 3.5 mm. in length and about 141  $\mu$  wide at the base. The anus is located about 1 mm. from the posterior end.

The females vary in length from 230 mm. to 280 mm. and in breadth from 5 mm. to 7 mm. The general cephalic structures are similar to those of the male. The oesophagus measures up to 14 mm. in length, and about 3 mm. wide. In a specimen 155 mm. long the vulva was located 75 mm. from the anterior extremity. There is a short vagina about 7 mm. long and 529  $\mu$  wide. The uteri are doubled for a short distance, and then divides into two thick uteri. The anus is located about 2.75 mm. from the posterior extremity. The ova are round, with finely pitted shells, and measure from 78  $\mu$  to 87  $\mu$  in diameter.

No.	Hosts.
3147,	<i>Equus grevyi</i> , (Grevy's zebra).
3148,	<i>Equus zebra</i> , (Hartmann's mountain zebra).
3149,	<i>Equus burchellii chapmani</i> , (Chapman's zebra).

*Physaloptera multiuteri* Canavan 1929.

The specimens are somewhat larger than those described by Canavan in 1929, which perhaps accounts for the differences in size of various organs. It must be also noted that there may be as many as fifteen uteri, but in general it appears that the usual number is fourteen. Otherwise the description given corresponds to that given by Canavan for the type specimens.

The males vary in length from 30 mm. to 55 mm. and in breadth from 1.5 mm. to 2 mm. The body is stout and reaches its maximum breadth just anterior to the bursa, and is slightly attenuated anteriorly. The cuticle shows a very delicate transverse striation, and is loosely attached to the body. It is reflected over the base of the lips. The cervical papillae are lateral and situated on the glandular portion of the oesophagus from 1.3 mm. to 1.37 mm. from the anterior end of the body. The excretory pore is about 200  $\mu$  further back as a rule, but may exceed 250  $\mu$  in the largest specimens. From the head there are two large sub-triangular lateral lips, each surmounted by a large external truncated tooth, and a tripartite inner tooth somewhat shorter in length and semi-membranous. There are no additional teeth. Each lip carries a sub-dorsal and a subventral dome-like papillae. The oesophagus varies in length from 6.5 mm. to 8.3 mm. The muscular portion varies in length from 700  $\mu$

to 970  $\mu$ , and in width from 247  $\mu$  to 317  $\mu$  at the posterior end. The glandular part varies from 5.5 mm. to 7.7 mm., and in width from 776  $\mu$  to 846  $\mu$  near the posterior end. The nerve ring encircles the muscular portion of the oesophagus in the posterior third.

The caudal alae are not sharply defined. Its ventral surface is covered with longitudinal rows of tubercles which extend on the sides to the last pair of papillae. There are 10 pairs of caudal papillae and one pre-cloaca unpaired. Four short, costiform pairs support the alae and are equally spaced around the cloaca. There are three sessile papillae in a line immediately anterior to the cloaca of which the middle unpaired one is slightly larger. There are two pairs of sessile papillae, not in a row, immediately caudad of the cloaca. Three sessile pairs are equally spaced further back, the last pair being just beyond half the distance from the cloaca and the end of the tail. The cloaca is located about 2.3 mm. from the tip of the tail. There are two short unequal spicules bluntly pointed. The right is 0.88 mm. in length and 95  $\mu$  wide at its base; the left 1 mm. long and somewhat thinner. Their origins are widely separated.

The females vary in length from 70 mm. to 90 mm. and in breadth from 2.5 mm. to 3 mm. The body is stout and slightly attenuated anteriorly. The cuticle is striated transversely, and has many irregular folds along the body. The general cephalic structures are similar to those of the male. The oesophagus is about 10 mm. long and the muscular portion about 1 mm. long.

The vulva is flush with the cuticle and opens in front of the mid-oesophageal region from 4 mm. to 4.5 mm. from the anterior end. The vagina is long and terminates into a club-like egg-sac. The transition is not sharply defined, and the combined length varies from 4.1 mm. to 5.8 mm. The vagina is about 176  $\mu$  wide near the vulva. The egg-sac varies in width from 0.62 mm. to 1 mm. From it 14 to 15 uteri are given off, they are twisted and terminate in the ovaries. Their width is approximately 158  $\mu$  at the base. The tail is about 2 mm. long. The ova measure about 27.2  $\mu$  by 41.3  $\mu$ , an average of 10, and contain fully developed embryo in the vagina.

No.

Hosts.

3150, 3151, 3152, 3153, 3154, *Ateles ater*, (spider monkey).

*Physaloptera* sp.

For various reasons the following specimens are listed as sp.

No.

Hosts.

3155, *Cercopithecus campbelli*, (Campbell's guenon).

3156, *Cercopithecus sabaeus*, (green monkey).

3157, *Lagothrix humboldtii*, (woolly monkey).

3158, 3159, *Vulpes velox*, (swift or kit fox).

3160, *Vulpes zerda*, (fennec fox).

3161, *Potos flavus*, (kinkajou).

*Setaria labiato-papillosa* (Alles. 1838).

Only two males were found. The characters check with those given for *Setaria labiato-papillosa*, except for the preanal vesicular structure and the

length of the left spicule which is given as 0.26 mm. to 0.27 mm. Baylis, (1929), and 0.33 mm. to 0.37 mm. Boulenger, (1920). However, I was only able to examine one left spicule and found it to be 662  $\mu$ , which could easily be a variation.

The males are about 50 mm. long, and 438  $\mu$  wide. The body is filiform and tapers toward each extremity. The cuticle appears smooth. The head is rounded and not separated from the rest of the body. Its diameter is about 142  $\mu$ . There is a prominent prebuccal ring present. It is much elongated dorso-ventrally and deeply notched laterally to give the appearance of strong dorsal and ventral teeth; however, these are not true teeth. The mouth is oval or round, and the cavity is triangular in form. There are 6 head papillae; 4 well-developed submedian, and 2 small laterals, sometimes inconspicuous. The oesophagus is about 8.3 mm. long, the anterior muscular part is about 794  $\mu$  long and 70  $\mu$  wide; and the posterior glandular part is about 7.5 mm. long and 247  $\mu$  maximum thickness near the middle. The nerve ring is located about 247  $\mu$  from the anterior end of the oesophagus.

The posterior extremity is somewhat spirally rolled and without caudal alae. There are 9 distinct pairs of caudal papillae; 4 preanal, 1 lateral, and 4 postanal. There is a crescent-like structure just anterior to the anus, which appears to be 3 indistinct median papillae, however, this may be only a preanal vesicular structure. Of the postanal papillae the third pair is the smallest. A pair of lateral appendages is located about 50  $\mu$  from the end of the tail. The tail is about 200  $\mu$  long, and 95  $\mu$  at its base and ends in a terminal knob. The spicules are very unequal, the left in one specimen measuring about 662  $\mu$  long, consisting of a long cylindrical anterior region followed by a much shorter terminal region which is largely membranous. The right spicule is about 91  $\mu$  long. It is stout, slightly curved and terminates in a sharp point.

The females are about 105 mm. long, and 776  $\mu$  wide. The cuticle and general cephalic characters are similar to those described for the male. The head diameter is about 206  $\mu$ . The oesophagus is about 10.584 mm. long; the anterior muscular part about 970  $\mu$  long and 123  $\mu$  wide; and the posterior glandular part is about 9.613 mm. long and 265  $\mu$  wide near the middle.

The vulva is located from 453  $\mu$  to 564  $\mu$  from the anterior end of the body. The vagina is coiled near the vulva, and measures about 6.4 mm. long and 70  $\mu$  wide near the vulva. It gradually widens to 247  $\mu$  where there is a distinct change into the uterus, which is about 564  $\mu$  wide, and continues almost the full length of the body. It narrows to form the coiled ovary. The lateral appendages are located about 145  $\mu$  from the end of the tail. The tail is about 520  $\mu$  to 616  $\mu$  long and 617  $\mu$  wide at the anus. It terminates in a knob-like extremity surrounded by an irregular ring of spines, variable in number. There are micro-filaria in the uterus.

No.

Hosts.

3162, 3163, *Bison bison*, (American bison).



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